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⑤④ **Printing sleeves and methods for mounting and dismounting such printing sleeves.**

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**DE-A- 2 542 748**  
**DE-A- 3 525 045**  
**DE-U- 8 532 300**  
**US-A- 4 503 769**

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## Description

### BACKGROUND OF THE INVENTION

This invention relates to printing sleeves which are readily mountable onto and dismountable from printing cylinders, and more particularly to printing sleeves which are expandably mountable and dismountable employing a pressurized gas.

In past printing operations, flexible printing plates were mounted onto the outer surface of a printing cylinder. These plates were used for printing of ink images onto a printing medium. Typically, the back of the plates was adhered directly to the printing cylinder. Since these plates were not readily interchangeable from one cylinder to another, the use of a multiplicity of printing cylinders to perform a multiplicity of jobs was required. This presented severe storage and cost problems to the end user.

Therefore, in an effort to overcome this problem, printing sleeves were developed which were mountable onto and dismountable from the printing cylinders. Compressed gas, generally compressed air, passing in a substantially radial direction from holes located within the printing cylinders, was used to expand the sleeve to a limited extent for facilitating the mounting and dismounting operations.

Early patents to describe this latter mode of mounting and dismounting of a printing sleeve were US-A-3,146,709 and US-A-3,978,254. Neither of the printing sleeves of these patents is unitary in construction, but is instead fabricated of a composite of wound materials. Furthermore, the outer surface of the US-A-3,978,254 wound sleeve has a plurality of surface irregularities formed therein and is therefore not "round" to the extent required by the flexographic printing industry. These carrier sleeves are made of a flexible, thin tape material which provides a minimum of structural integrity, which exhibits minimal strength and durability properties and leaves a leakage path for the air.

Another type of printing sleeve is one which is made of a metallic material. As in the case of wound sleeves, metallic sleeves are not readily expandable and therefore must have a wall thickness which is quite thin, i.e., thicknesses of up to only about 0.127mm (0.005"), in order to be capable of undergoing the limited expansion required of printing sleeves.

Dimensional stability is a problem in printing applications requiring that the outer surface of a printing sleeve structure have a true cylindrical shape. In some cases, this true cylindrical shape must even be within a 0.0254 - 0.0635 mm (0.001" - 0.0025") tolerance level in order to be acceptable in, for example, uses such as in the process print-

ing industry. The outer printing surface in these applications must accurately conform to a uniformly constant, cylindrical outer shape in order to accurately imprint a print image onto a printing medium. Many of these prior art printing sleeves do not meet these requisite tolerance levels.

U.S. 4,144,812 and U.S. 4,144,813 provide non-cylindrical printing sleeves and associated air-assisted printing rolls designed in a tapered or stepped-transition configuration and fabricated of a highly rigid material having a low degree of expandability. These sleeves have a thickness of about 0.038 cms (0.015"). An extremely high air pressure, in excess of 86.23 N/cm<sup>2</sup> (125 psi), and typically about 172.36 N/cm<sup>2</sup> (250 psi) or higher, is thus required to be introduced as the sleeve is being fitted onto the underlying air-assisted, printing roll in order to extend the radial dimension of the printing sleeve to a position capable of achieving complete coverage of the printing cylinder by the sleeve. Complete coverage is required in this system to achieve a proper interference fit. Since a pressure in excess of 86.23 N/cm<sup>2</sup> (125 psi) is required herein, the system must satisfy various governmental regulations relating to pressure-rated containers. Generally 34.43 to 68.96 N/cm<sup>2</sup> (50-100 psi) air pressure is available in production facilities.

In specification DE-A-2542748 and corresponding US-A-4,089,265, a flexographic printing roll is provided comprising a rigid base tube having perforations in the form of a plurality of small apertures, each leading to a circumferentially extending groove and a stretchable elastomeric printing sleeve on the tube strained to grip the tube to retain the sleeve securely on the tube. There is no underlying printing cylinder in the conventional sense in this system, and the sleeve is too flexible for stability.

In DE-U-8532300 a metal inner cylinder is provided with closely spaced circumferentially extending grooves covered by a fibre reinforced plastics material sleeve of undisclosed properties. Such a cylinder and sleeve is not seen to have the desired properties for high quality process printing application.

Therefore, a need exists for a cylindrically-shaped printing sleeve which is unitary and airtight, which can be frictionally mounted onto conventional cylindrically-shaped printing cylinders having a complementary outside diameter, which is readily expandable using a low pressure fluid, and which has a wall thickness and a true outer wall surface capable of being used in process printing applications.

The present invention provides a unitary cylindrically-shaped printing sleeve, readily axially mountable on and dismountable from a complementary printing cylinder, having a constant cross-

sectional diameter which comprises a sleeve body, having a substantially constant cross-sectional diameter, which is substantially airtight when mounted onto said printing cylinder, and which has seamless inner and outer cylindrically-shaped wall surfaces, the diameter of said printing sleeve being expandable by the introduction of a pressure fluid between said inner printing sleeve wall surface and the outer wall surface of said printing cylinder, said printing sleeve being contractable by the removal of said pressure fluid, and characterised in that the sleeve has a stiffness factor of at least  $8.1 \times 10^4$  N m ( $7.26 \times 10^5$  inch-pounds) and a flexural modulus of at least  $4.1 \times 10^5$  N/cm<sup>2</sup> ( $6 \times 10^5$  psi). The preferred printing sleeves of this invention have a wall thickness of at least 0.038 cms (0.015").

Mounting of the printing sleeves of the present invention onto a conventional printing cylinder can be readily accomplished by expanding the diameter of these sleeves by the introduction of a relatively low fluid pressure between the inner wall surface of the sleeve and the outer wall surface of the printing cylinder. Preferably, in the printing sleeves of this invention, each of the inner and outer wall surfaces of the printing sleeve body has a substantially constant diameter. The printing sleeve is contractable by removing the expanding forces.

Typically, the expanding forces are applied using a low pressure fluid, such as low pressure air and the like. The low pressure fluid is typically introduced at a pressure, at ambient temperature, of not more than about 68.96 N/cm<sup>2</sup> (100 psi), preferably not more than about 55.13 N/cm<sup>2</sup> (80 psi), and more preferably not more than about 34.43 N/cm<sup>2</sup> (50 psi), whereby the cross-sectional diameter of the printing sleeve is expanded for mounting of the printing sleeve onto the printing cylinder. The ability to use lower pressure gas is important since most production facilities do not have, for example, high pressure gas available for conducting the mounting and dismounting operations. Moreover, since this pressure is below 86.23 N/cm<sup>2</sup> (125 psi), there is no problem with government regulations as a pressure-rated container.

The printing sleeve flexural modulus is more preferably at least  $6.9 \times 10^5$  N/cm<sup>2</sup> ( $10 \times 10^5$  lbs/in<sup>2</sup>). This provides excellent structural integrity but at the same time the low flexural modulus value permits the required level of expandability with the above described introduction of a relatively low pressure fluid. For purposes of this invention, flexural modulus was determined using ASTM (American Standard Testing Methods) D2412.

The printing sleeve of the present invention can also be fabricated with a wall thickness substantially greater than conventional metal printing

sleeves. Preferably, this wall thickness is at least 0.038 cms (0.015"), more preferably at least 0.051 cms (0.020"), and most preferably at least 0.102 cms (0.040"). In this way, printing plates having a much higher range of thicknesses can be employed. Although sleeves having a larger wall thickness can be fabricated by the teachings of this invention, a practical upper limit may be a wall thickness of about 0.3 cms (0.120").

By employing the subject printing sleeve, a stiffness factor, i.e., the ratio of the flexural modulus to the minimum wall thickness, can be attained of from about .0559 to 3.384 N m (0.5 to 30 inch-pounds), more preferably from about .1128 to 2.26 N m (1 to 20 inch-pounds), and most preferably from about 0.226 to 1.128 N m (2 to 10 inch-pounds). This clearly describes a printing sleeve construction having a high level of strength and expandability. The stiffness factor was determined using ASTM (American Standard Testing Methods) D2412(10.2).

The printing sleeves of this invention are typically fabricated of a non-metallic material, preferably a polymeric material. The printing sleeves preferably comprise a reinforced non-permeable laminate structure including at least one reinforcing internal layer of a woven fabric of synthetic fibers or organic fibers, for particularly providing high tensile strength. A second internal layer may also be included which comprises at least one non-permeable internal layer, typically synthetic fibers. Preferably, the synthetic and organic fibers are of high strength, and the reinforced non-permeable internal layers comprise a non-woven fabric of synthetic fibers.

The outer wall surface of the printing sleeve exhibits a limited dimensional tolerance whereby printing plates can be mounted for complementary frictional engagement onto the outer wall surface of the printing sleeve so that the printing elements of differing colors located on the printing plate surface register within the exact specifications required for conducting process printing operations. Preferably, the printing sleeve exhibits a maximum difference in the trueness of its outer wall surface, when the sleeve is mounted on a true cylinder, is not more than 0.0127 cms (0.005"), preferably not more than .00635 cms (0.0025"), and most preferably not more than .00254 cms (0.001").

This invention also relates to a method for axially mounting the previously described printing sleeves.

The foregoing and other objects, features and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment which proceeds with reference to the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of an enlarged, cylindrically-shaped printing sleeve of the present invention as mounted on a printing cylinder.

FIG. 2 is a perspective view of the cylindrically-shaped printing sleeve of FIG. 1.

FIG. 3 is an enlarged sectional view taken along 3-3 of FIG. 2.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, a cylindrically-shaped printing sleeve 10 is provided which comprises cylindrically-shaped inner and outer walls 14 and 15 which define a hollow inner chamber 16, and a pair of end sections 18 and 20. Sleeve 10 is depicted mounted on an illustrative conventional printing cylinder 22, such as described in FIG. 3 of U.S. 3,146,709.

Typically, sleeve 10 will serve as a support for the application of printing plates 24, preferably flexographic printing plates (see FIG. 3 in phantom), which are generally made of a flexible polymeric material. Any suitable indicia for printing onto a printing medium may be set on these printing plates. Alternatively, outer wall 15 may itself be employed as the means for printing onto a printing medium. Various methods can be employed to engrave the outer wall 15. For example, one could employ chemical or photochemical engraving techniques to form the requisite means for printing the print indicia.

The printing sleeve 10 and the printing cylinder 22 are cylindrical and have a constant diameter. The outer wall 23 of the cylinder 22 has a slightly larger diameter than the inner wall 14 so that the sleeve will firmly frictionally fit onto the cylinder. The cylinder 22 is hollow and has a cylindrical chamber 25 which is used as a compressed air chamber. The cylinder 22 comprises a cylindrical tube 26 fitted with airtight endplates 28 and 29. A plurality of spaced-apart, radially-extending apertures 30 are provided in the tube 26 through which air from the chamber 25 may pass for expanding the sleeve 10 during mounting and dismounting operations. Air is introduced into the chamber 25 through air hose 34. Trunnions 31 and 32 are provided for rotationally supporting cylinder 22. A coupling element 33 is disposed within endplate 29 and provides a means for connecting air hose 34 to cylinder 22 for introducing compressed air to the cylinder chamber 25.

The cylindrically-shaped printed sleeve 10 typically comprises a reinforced, non-permeable laminate structure. An example of a typical formation process for producing such a reinforced non-per-

meable laminate printing sleeve is as follows: A typical internal steel mandrel of about 168 cms (5.5 feet) in length and about 3.8 to 38 cms (1.5-15 inches) in diameter is employed as the structural form in the fabrication of the reinforced non-permeable laminate printing sleeve 10. The mandrel is a cylindrically-shaped printing cylinder having a hollow internal chamber and a substantially cylindrically-shaped outer wall surface including an array of holes located in the cylinder wall. The pressurized air employed to expand a printing sleeve passes from the internal chamber outwardly through the array of air holes. In the printing sleeve formation process these air holes are first taped shut in order to prevent the synthetic resin employed in forming the printing sleeve from passing through the air holes into the central chamber of the mandrel. The diameter of the outer wall section of the printing cylinder is sized to produce a printing sleeve having an inner wall surface of substantially constant diameter, the magnitude of such inner wall being slightly smaller than the diameter of the outer wall section of the printing cylinder on which it will ultimately be mounted to promote an interference fit of the sleeve about the ultimate printing cylinder.

The printing sleeve formation process can be initiated by applying a mold-release agent such as polyvinyl alcohol and the like, onto the outer wall section of the mandrel. The use of this agent allows the sleeve to be readily removed from its position about the mandrel after the formation process has been completed. Next, a synthetic resin capable of being formed into a unitary, airtight printing sleeve body having the physical properties previously described is applied to the outer wall section of the mandrel. For example, Derakane<sup>®</sup>, a vinyl ester resin manufactured by the Dow Chemical Company, can be employed for this purpose. The catalyst used in curing the resin is a methyl ethyl ketone peroxide material, such as Hi Point 90 manufactured by Witco Chemical Corporation. The resin, when cured, has a high degree of toughness, chemical resistance, impact resistance and a high level of tensile strength.

An internal reinforcing layer of high strength synthetic or organic fibers can then be applied about the resin material. Typically, at least one reinforcing composition layer is employed for this purpose because of its generally high strength and lightweight properties. In the preferred case, as shown in FIG. 3 a single layer 17 of a woven composite of synthetic fibers, such as aramid fibers manufactured by DuPont under the registered trademark Kevlar<sup>®</sup>, is used herein. Kevlar<sup>®</sup> is available in a number of fabric weaves. In this case, a single layer of 0.6 kg/m<sup>2</sup> (1.8 oz per square yard) Kevlar<sup>®</sup> aramid fibers was employed as the reinforcing

ing composite material. Alternatively, woven fiber-glass filaments in the form of a composite boat cloth fabric can be employed as the internal reinforcing layer. For instance, a boat cloth composite fabric manufactured by Owens Corning can be used herein.

At least one layer of a non-permeable material, such as a non-woven, non-apertured synthetic material, is then preferably wrapped about the internal reinforcing layer. In this case, as depicted in FIG. 3, four layers of the non-woven, non-apertured material 13 were applied. A polyester non-woven polymeric web, such as Nexus<sup>®</sup>, manufactured by Burlington Industries, is useful for this purpose. This material provides the overall printing sleeve structure with machinability, shock resistance, and, when saturated with resin, provides a fluid-tight, and particularly an airtight, barrier. The remaining portion of the resinous material was then applied thereto.

Next, the completed structure was allowed to cure for a period of time so that the resin would become cured and crosslinked and dimensionally stable. This was accomplished under exothermic conditions for a period of time of about two hours. The formation mandril was continually rotated during the exothermic period. The printing sleeve was then removed from the mandril and post-cured for a period of time and at an elevated temperature. Here, the post-cure was conducted for a period of 30 minutes at a temperature of 77°C (170°F), in a post-cure oven. The printing sleeve was then removed from the oven and allowed to cool to ambient temperature.

At that time, the interference fit was checked to determine whether it was within acceptable parameters. Preferably, the interference fit of the sleeve about the printing cylinder is from about 0.018 cms (0.007") up to about 0.038 cms (0.015"), and more preferably from about 0.0228 cms (0.009") up to about 0.033 cms (0.013"). The printing sleeve was then machined to the requisite outer cylindrically-shaped wall section dimension, employing a lathe.

The dimensional tolerance of the printing sleeve was determined by using a dial indicator to measure the overall axial variation in the diameter of the entire surface of the outer wall section of the printing sleeve. For flexographic printing use, the limited dimensional tolerance of the printing sleeve should be not more than about 0.0025 cms (0.001"). This type of printing is known as process printing. The printing sleeve produced herein met the criteria for process printing use. However, for other uses such as line printing, which includes bread bag printing and the like, a limited dimensional tolerance of not more than 0.0063 cms (0.0025") is acceptable. Finally, in newsprint applications or the like where fine printing is not a

critical parameter, limited dimensional tolerances of not more than about 0.0127 cms (0.005") can be employed.

## Claims

1. A unitary cylindrically-shaped printing sleeve (10), readily axially mountable on and dismountable from a complementary printing cylinder (22) having a constant cross-sectional diameter, which comprises a sleeve body, having a substantially constant cross-sectional diameter, which is substantially airtight when mounted onto said printing cylinder, and which has seamless inner and outer cylindrically-shaped wall surfaces (14, 15), the diameter of said printing sleeve being expandable by the introduction of a pressure fluid between said inner printing sleeve wall surface and the outer wall surface (23) of said printing cylinder, said printing sleeve being contractable by the removal of said pressure fluid and characterised in that the sleeve has a stiffness factor of at least  $8.1 \times 10^4$  N m ( $7.26 \times 10^5$  inch-pounds) and a flexural modulus of at least  $4.1 \times 10^5$  N/cm<sup>2</sup> ( $6 \times 10^5$  psi).
2. A printing sleeve according to claim 1 characterised in that each of said respective wall surfaces (14, 15) of said printing sleeve body has a substantially constant diameter.
3. A printing sleeve according to claim 1 or claim 2 characterised in that said printing sleeve has a thickness of at least 0.038 cms (0.015").
4. A printing sleeve according to any of claims 1 to 3 wherein said printing sleeve is fabricated of a non-metallic material.
5. A printing sleeve according to any of claims 1 to 3 wherein said printing sleeve is fabricated of a polymeric material.
6. A printing sleeve according to any of claims 1 to 5 characterised in that it comprises a reinforced laminate structure.
7. A printing sleeve according to claim 6 characterised in that the laminate structure includes at least one internal layer of a woven reinforcing fabric comprising either one of synthetic fibers and organic fibers.
8. A printing sleeve according to claim 7, characterised in that the reinforced laminate structure further includes at least one non air permeable internal layer comprising synthetic fibers.

9. A printing sleeve according to claim 7 or 8, characterised in that the or each said reinforced internal layer comprise a non-woven fabric of synthetic fibers.

10. A printing sleeve according to any of claims 1 to 9 characterised in that the maximum difference in the diameter of the outer wall surface (15) of the printing sleeve, when said printing sleeve is mounted on a cylinder of constant diameter, is not more than about .0127 cms (0.005").

11. The printing sleeve of claim 1 or 2 wherein said pressure fluid is introduced at a level of not more than about 68.96 N/cm<sup>2</sup> (100 psi) at ambient temperature.

12. The printing sleeve of claim 5, wherein said polymeric laminate sleeve comprises a synthetic resin having a high degree of toughness and impact resistance, and a high level of tensile strength.

13. In combination a printing sleeve according to any of the preceding claims and a printing cylinder of constant cross-sectional diameter on which the sleeve is mounted with an interference fit, the cylinder being formed with radially opening apertures under the sleeve.

14. A method for axially mounting a cylindrically-shaped printing sleeve onto a complementary printing cylinder having a constant cross-sectional diameter which comprises:

providing a printing sleeve according to any of claims 1 to 12;

expanding said printing sleeve by introducing a pressure fluid to a diameter slightly greater than the diameter of the printing cylinder;

axially moving said expanded printing sleeve to a position onto said printing cylinder; and

contracting said expanded printing sleeve by removing said pressure fluid and thereby mounting said printing sleeve onto said printing cylinder to form a minimum interference fit between said printing cylinder and said printing sleeve, respectively.

15. A method according to claim 14, wherein said printing sleeve is expanded by introducing a fluid at a pressure of not more than 68.96 N/cm<sup>2</sup> (100 psi).

#### Patentanspruch

1. Einheitlich zylindrisch geformte Druckhülse (10), die auf einen entsprechenden Druckzylinder (22) mit konstantem Durchmesser einfach axial montierbar und von diesem demontierbar ist, mit einem Hülsekörper mit einem im wesentlichen konstanten Durchmesser, der nach erfolgter Montage auf den Druckzylinder im wesentlichen luftdicht ist und nahtlose zylinderförmige Innen- und Außenwandflächen (14, 15) aufweist, wobei der Durchmesser der Druckhülse durch Einleiten eines Druckfluids zwischen die Innenwandfläche der Druckhülse und die Außenwandfläche (23) des Druckzylinders expandierbar und durch Entfernen des Druckfluids kontrahierbar ist, dadurch gekennzeichnet, daß die Hülse einen Steifigkeitsfaktor von wenigstens  $8.1 \times 10^4$  Nm ( $7.26 \times 10^5$  inch/pounds) und einen Elastizitätsmodul von wenigstens  $4.1 \times 10^5$  N/cm<sup>2</sup> ( $6 \times 10^5$  psi) aufweist.

2. Druckhülse nach Anspruch 1, dadurch gekennzeichnet, daß jede Wandfläche (14, 15) des Druckhülsekörpers einen im wesentlichen konstanten Durchmesser aufweist.

3. Druckhülse nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Druckhülse eine Dicke von wenigstens 0.038 cm (0.015") aufweist.

4. Druckhülse nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Druckhülse aus einem nichtmetallischen Material gefertigt ist.

5. Druckhülse nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Druckhülse aus einem Polymer hergestellt ist.

6. Druckhülse nach einem der Ansprüche 1 bis 5, gekennzeichnet durch einen verstärkten Laminataufbau.

7. Druckhülse nach Anspruch 6, dadurch gekennzeichnet, daß der Laminataufbau zumindest eine innere Lage aus einem Verstärkungsgebe mit entweder synthetischen oder organischen Fasern aufweist.

8. Druckhülse nach Anspruch 7, dadurch gekennzeichnet, daß der verstärkte Laminataufbau ferner wenigstens eine luftundurchlässige innere Schicht mit synthetischen Fasern aufweist.

9. Druckhülse nach einem der Ansprüche 7 oder 8, dadurch gekennzeichnet, daß die oder jede

verstärkte innere Lage ein Vlies aus synthetischen Fasern aufweist.

10. Druckhülse nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die maximale Differenz im Durchmesser der Außenwandfläche (15) der Druckhülse nach Aufbringen derselben auf einen Zylinder mit konstantem Durchmesser nicht mehr als 0.0127 cm (0.005") beträgt. 5
11. Druckhülse nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Druckfluid mit einem Druck von nicht mehr als 68.96 N/cm<sup>2</sup> (100 psi) bei Raumtemperatur eingebracht wird. 10
12. Druckhülse nach Anspruch 5, dadurch gekennzeichnet, daß die polymere Laminathülse Kunstharz von hoher Zähigkeits- und Schlagfestigkeit und hoher Zugfestigkeit aufweist. 15
13. Druckhülse nach einem der vorangehenden Ansprüche in Verbindung mit einem Druckzylinder mit konstantem Durchmesser, auf dem die Hülse mit Preßsitz angebracht ist, wobei im Zylinder unterhalb der Hülse sich in radiale Richtung erstreckende Öffnungen ausgebildet sind. 20
14. Verfahren zum axialen Montieren einer zylinderförmigen Druckhülse auf einem entsprechenden Druckzylinder mit konstantem Durchmesser mit folgenden Merkmalen: 25
  - Bereitstellen einer Druckhülse nach einem der Ansprüche 1 bis 12;
  - Expandieren der Druckhülse durch Einleiten eines Druckfluides auf einen Durchmesser, der etwas größer ist als der Durchmesser des Druckzylinders;
  - axiales Verlagern der expandierten Druckhülse in eine Position auf dem Druckzylinder und 30
  - Kontrahieren der erweiterten Druckhülse durch Entfernen des Druckfluides zum Aufbringen der Druckhülse auf den Druckzylinder unter Ausbildung eines Minimum-Preßsitzes zwischen dem Druckzylinder und der Druckhülse. 35
15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß die Druckhülse durch Einleiten eines Fluides mit einem Druck von nicht mehr als 68.96 N / cm<sup>2</sup> (100 psi) aufgeweitet wird. 40

#### Revendications

1. Manchon d'impression (10) ayant une forme cylindrique d'une seule pièce, aisément montable et démontable axialement sur un cylindre 45

d'impression complémentaire (22) ayant une section de diamètre constant, qui comprend un corps de manchon, ayant une section de diamètre sensiblement constant, qui est sensiblement étanche à l'air lorsqu'il est monté sur le dit cylindre d'impression, et qui possède des surfaces de paroi interne et externe de forme cylindrique (14, 15) sans jointure, le diamètre du dit manchon d'impression étant expensible par l'introduction d'un fluide sous pression entre la dite surface de paroi interne du manchon d'impression et la surface de paroi externe (23) du dit cylindre d'impression, le dit manchon d'impression pouvant être contracté par la suppression du dit fluide sous pression et caractérisé en ce que le manchon a un facteur de rigidité d'au moins  $8,1 \times 10^4$  Nm ( $7,26 \times 10^5$  pouce-livres) et un module de flexion d'au moins  $4,1 \times 10^5$  N/cm<sup>2</sup> ( $6 \times 10^5$  psi).

2. Manchon d'impression selon la revendication 1, caractérisé en ce que chacune des dites surfaces de paroi respectives (14, 15) du dit corps de manchon d'impression a un diamètre sensiblement constant.
3. Manchon d'impression selon la revendication 1 ou la revendication 2, caractérisé en ce que le dit manchon d'impression a une épaisseur d'au moins 0,038 cm (0,015").
4. Manchon d'impression selon l'une quelconque des revendications 1 à 3, caractérisé en ce que le dit manchon d'impression est fabriqué dans un matériau non métallique.
5. Manchon d'impression selon l'une quelconque des revendications 1 à 3, caractérisé en ce que le dit manchon d'impression est fabriqué dans un matériau polymère.
6. Manchon d'impression selon l'une quelconque des revendications 1 à 5, caractérisé en ce qu'il comprend une structure feuilletée renforcée.
7. Manchon d'impression selon la revendication 6, caractérisé en ce que la structure feuilletée comprend au moins une couche interne d'une étoffe de renfort comprenant des fibres synthétiques et/ou des fibres organiques.
8. Manchon d'impression selon la revendication 7, caractérisé en ce que la structure feuilletée renforcée comprend, de plus, au moins une couche interne imperméable à l'air, comprenant des fibres synthétiques.

9. Manchon d'impression selon la revendication 7 ou 8, caractérisé en ce que la ou chaque couche interne renforcée comprend une étoffe non tissée de fibres synthétiques. 5
10. Manchon d'impression selon l'une quelconque des revendications 1 à 9, caractérisé en ce que la différence maximale de diamètre de la surface de paroi externe (15) du manchon d'impression, lorsque le dit manchon d'impression est monté sur un cylindre de diamètre constant, est inférieure ou égale à 0,0127 cm (0,005"). 10
11. Manchon d'impression selon la revendication 1 ou 2, caractérisé en ce que le dit fluide sous pression est introduit à une pression maximale de 68,96 N/cm<sup>2</sup> (100 psi) à température ambiante. 15
12. Manchon d'impression selon la revendication 5, caractérisé en ce que le dit manchon feuilleté polymère comprend une résine synthétique ayant un haut degré de dureté et de résistance au choc, et un haut niveau de résistance à la traction. 20
13. Combinaison d'un manchon d'impression selon l'une quelconque des revendications précédentes et d'un cylindre d'impression de section à diamètre constant, sur lequel le manchon est monté à ajustement serré, le cylindre étant formé avec des ouvertures s'ouvrant radialement sous le manchon. 25
14. Procédé pour monter axialement un manchon d'impression de forme cylindrique sur un cylindre d'impression complémentaire ayant une section à diamètre constant qui comprend les étapes suivantes : 30
- fournir un manchon d'impression selon l'une quelconque des revendications 1 à 12, 35
  - dilater le dit manchon d'impression en introduisant un fluide sous pression jusqu'à un diamètre légèrement supérieur au diamètre du cylindre d'impression, 40
  - déplacer axialement le dit manchon d'impression dilaté jusqu'à une certaine position sur le dit cylindre d'impression et, 45
  - contracter le dit manchon d'impression dilaté en supprimant le dit fluide sous pression de manière à monter le dit manchon d'impression sur le dit cylindre d'impression pour former un ajustement serré minimal entre, respectivement, le dit cylindre d'impression et le dit manchon d'impression. 50

FIG. 2

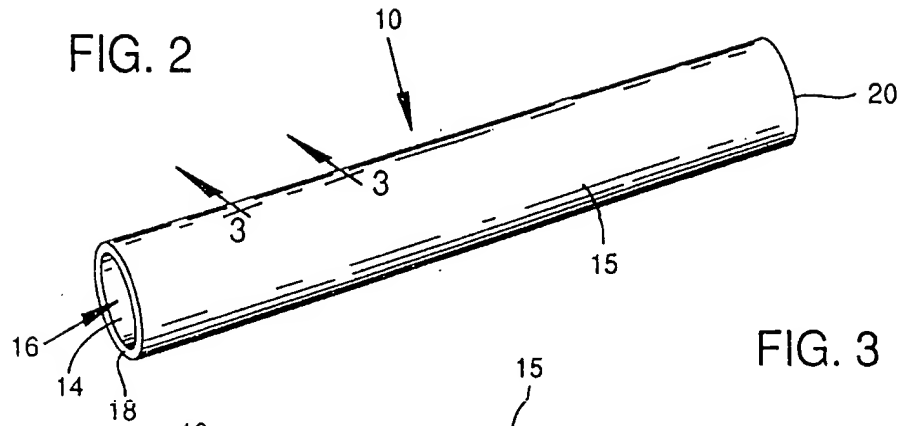


FIG. 3

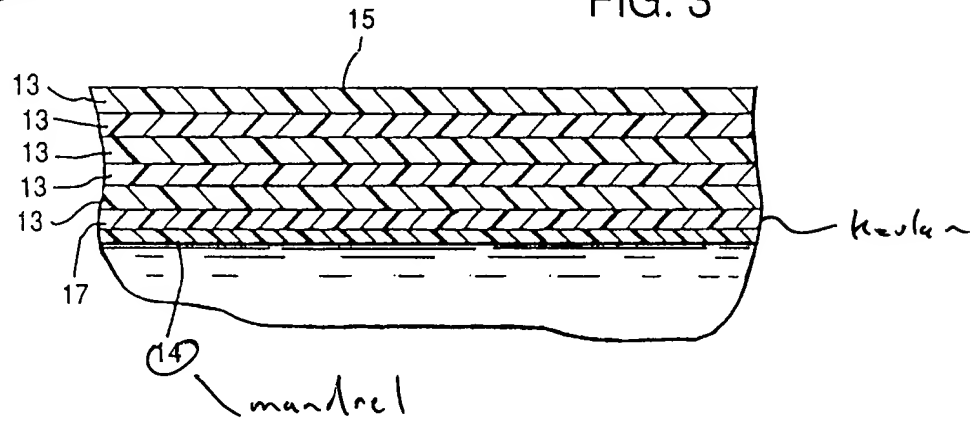


FIG. 1

